US009303560B2

(12) **United States Patent**
Jackson

(10) **Patent No.: US 9,303,560 B2**
(45) **Date of Patent: Apr. 5, 2016**

(54) **SCREW SHAFT TURBINE COMPRESSOR AND SYSTEM**

(71) Applicant: **John R. Jackson**, Littleton, CO (US)

(72) Inventor: **John R. Jackson**, Littleton, CO (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 66 days.

(21) Appl. No.: **14/177,668**

(22) Filed: **Feb. 11, 2014**

(65) **Prior Publication Data**

US 2014/0157751 A1 Jun. 12, 2014

Related U.S. Application Data

(63) Continuation-in-part of application No. 12/876,836, filed on Sep. 7, 2010, now Pat. No. 8,689,535, which is a continuation-in-part of application No. 11/774,418, filed on Jul. 6, 2007, now Pat. No. 7,788,896.

(51) **Int. Cl.**

F02C 3/073	(2006.01)
F01D 1/38	(2006.01)
F01D 5/02	(2006.01)
F01D 5/06	(2006.01)
F01D 5/08	(2006.01)
F02C 3/045	(2006.01)
F02C 7/266	(2006.01)

(52) **U.S. Cl.**

CPC . ***F02C 3/073*** (2013.01); ***F01D 1/38*** (2013.01); ***F01D 5/023*** (2013.01); ***F01D 5/066*** (2013.01); ***F01D 5/085*** (2013.01); ***F02C 3/045*** (2013.01); ***F02C 7/266*** (2013.01); *Y02T 50/672* (2013.01); *Y02T 50/676* (2013.01)

(58) **Field of Classification Search**

CPC F02C 3/073; F02C 3/045; F02C 7/266; F01D 1/38; F01D 5/023; F01D 5/066; F01D 5/085; Y02T 50/672; Y02T 50/676

See application file for complete search history.

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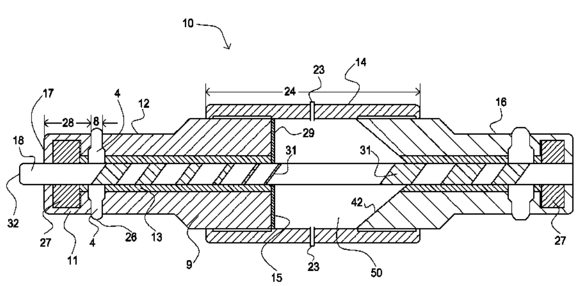
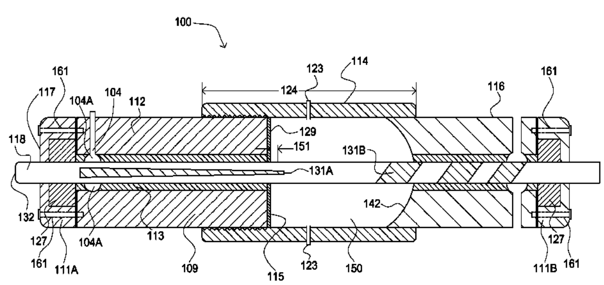
Primary Examiner — Ehud Gartenberg
Assistant Examiner — Karthik Subramanian
(74) *Attorney, Agent, or Firm* — Leyendecker & Lemire, LLC

(57) **ABSTRACT**

Disclosed herein are screw shaft turbine compressors having (i) a compressor section, (ii) a turbine section, (iii) a combustion section coupling to the compressor section and the turbine section, and (iv) a grooved shaft. The grooved shaft can include one or more grooves for providing fuel from the compressor section to the combustion section and for allowing exhaust to leave the combustion section and exit the turbine section. A method for generating different speed to torque ratios on the shaft and a system for generating torque on the shaft are further disclosed.

19 Claims, 10 Drawing Sheets





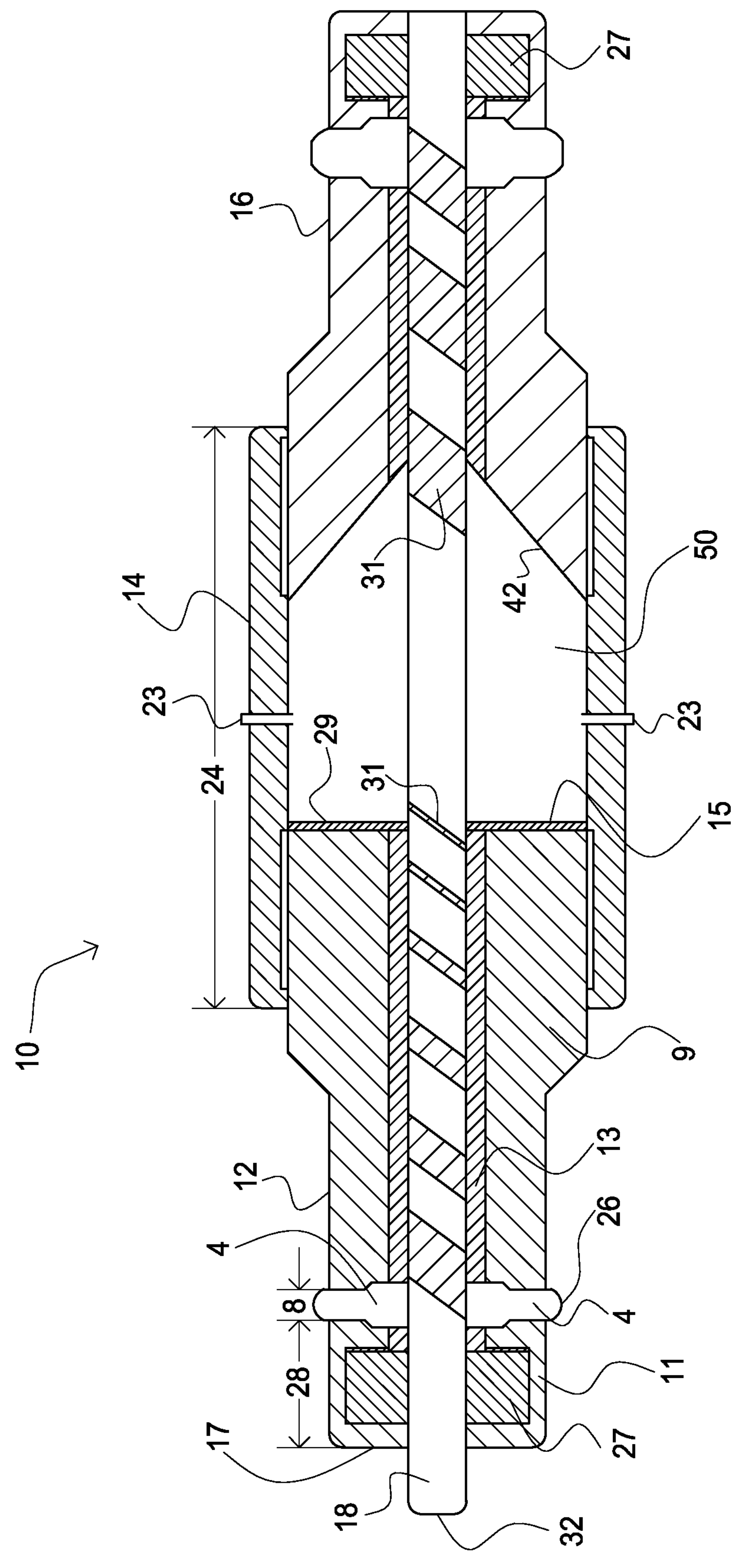


Fig. 1

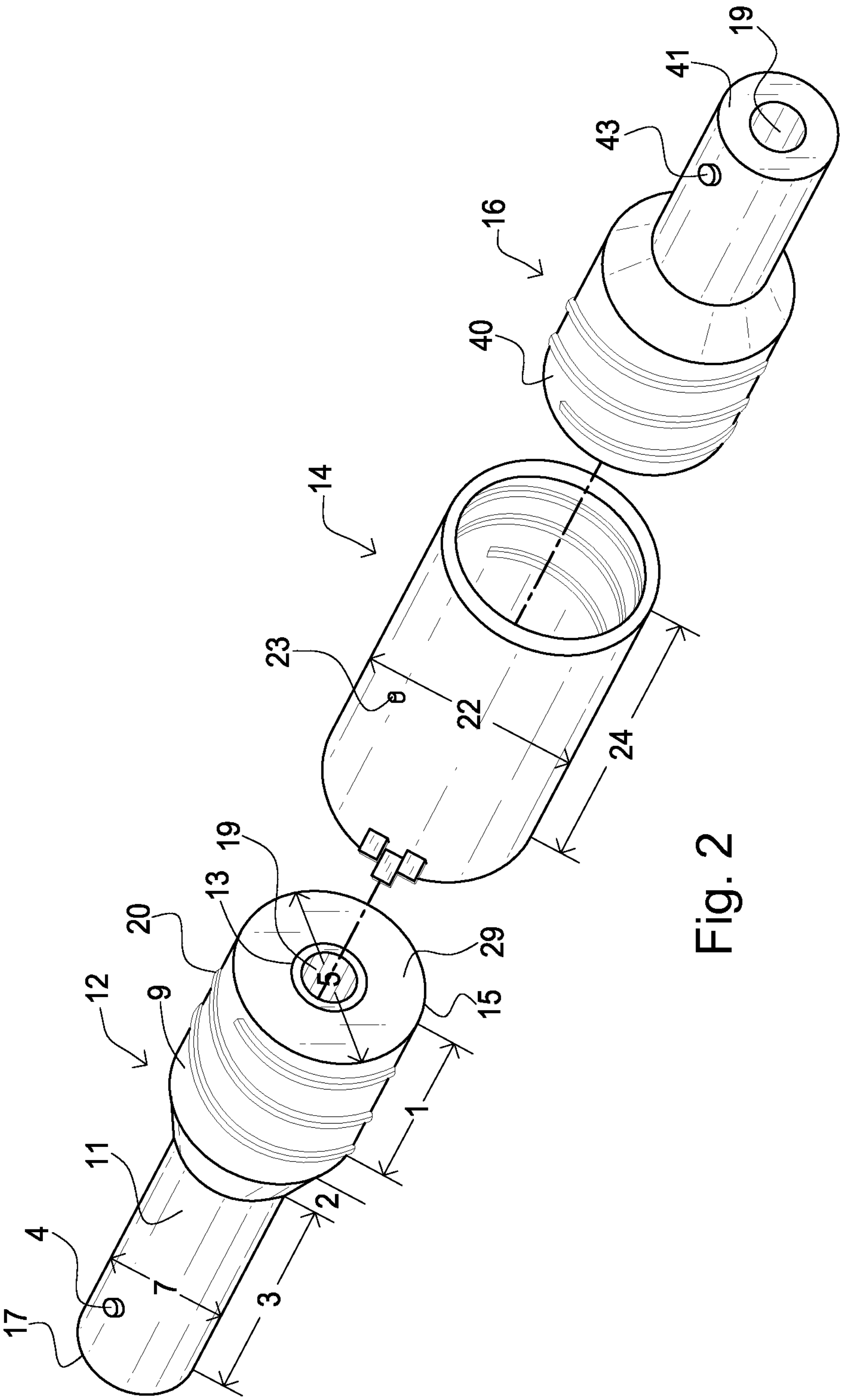


Fig. 2

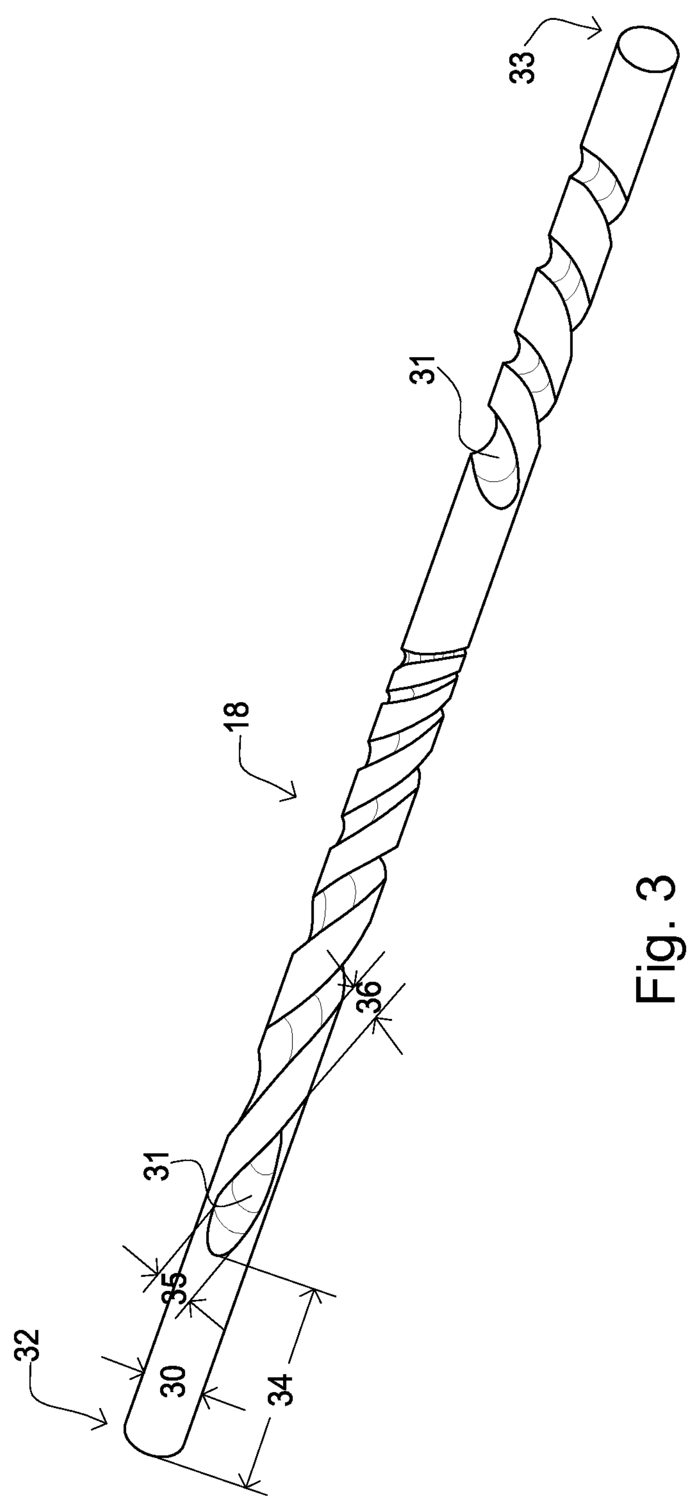


Fig. 3

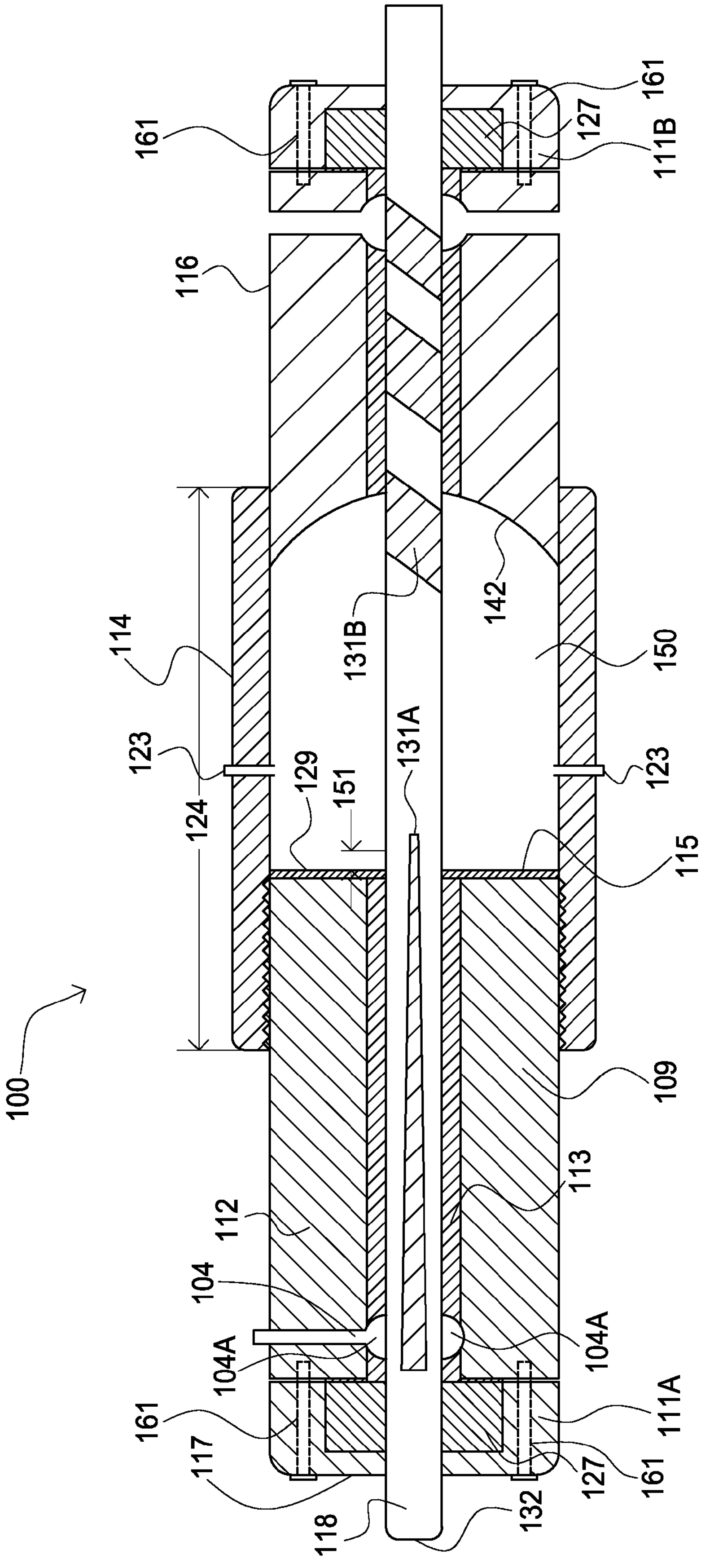

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Fig. 4

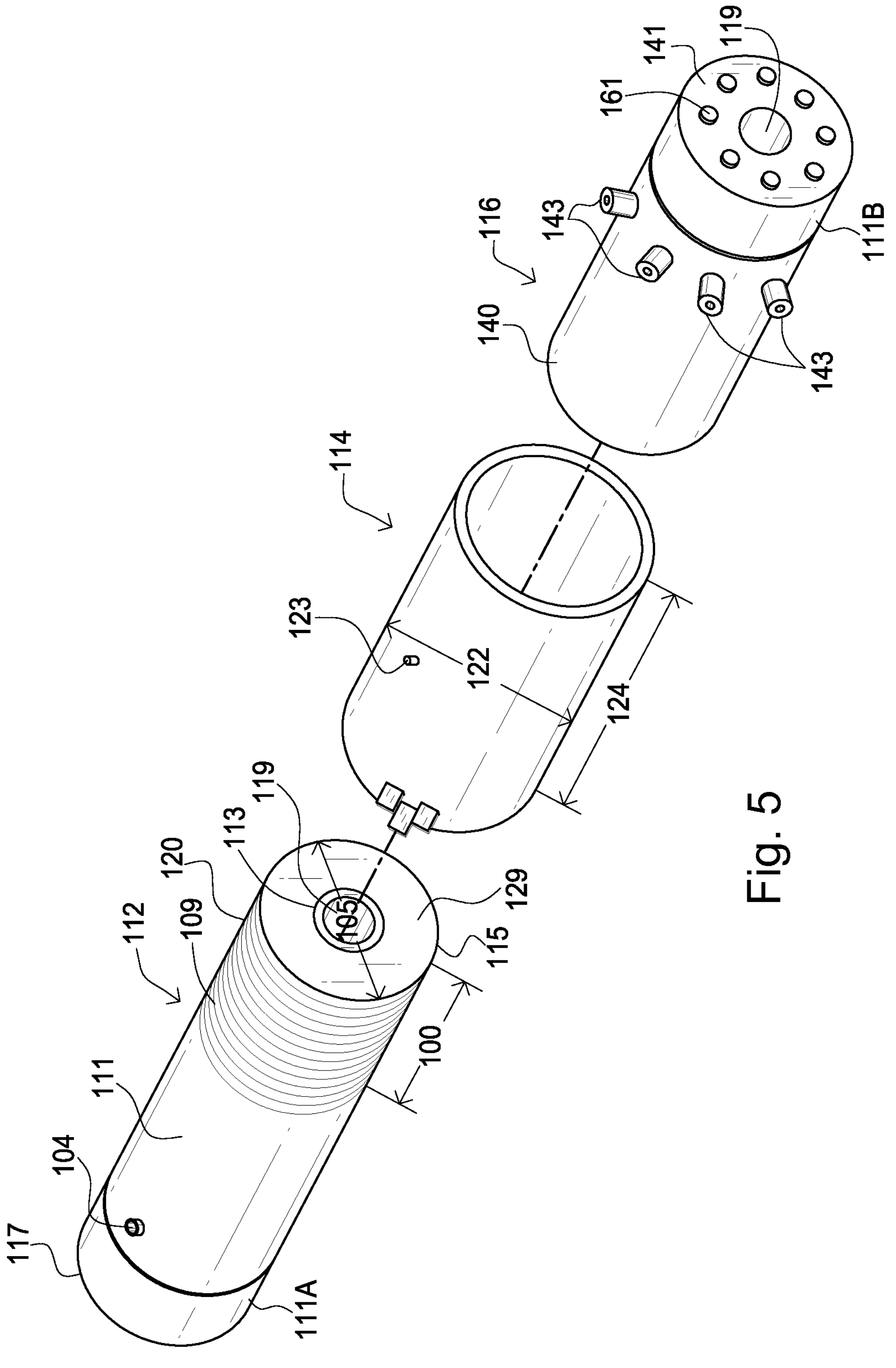
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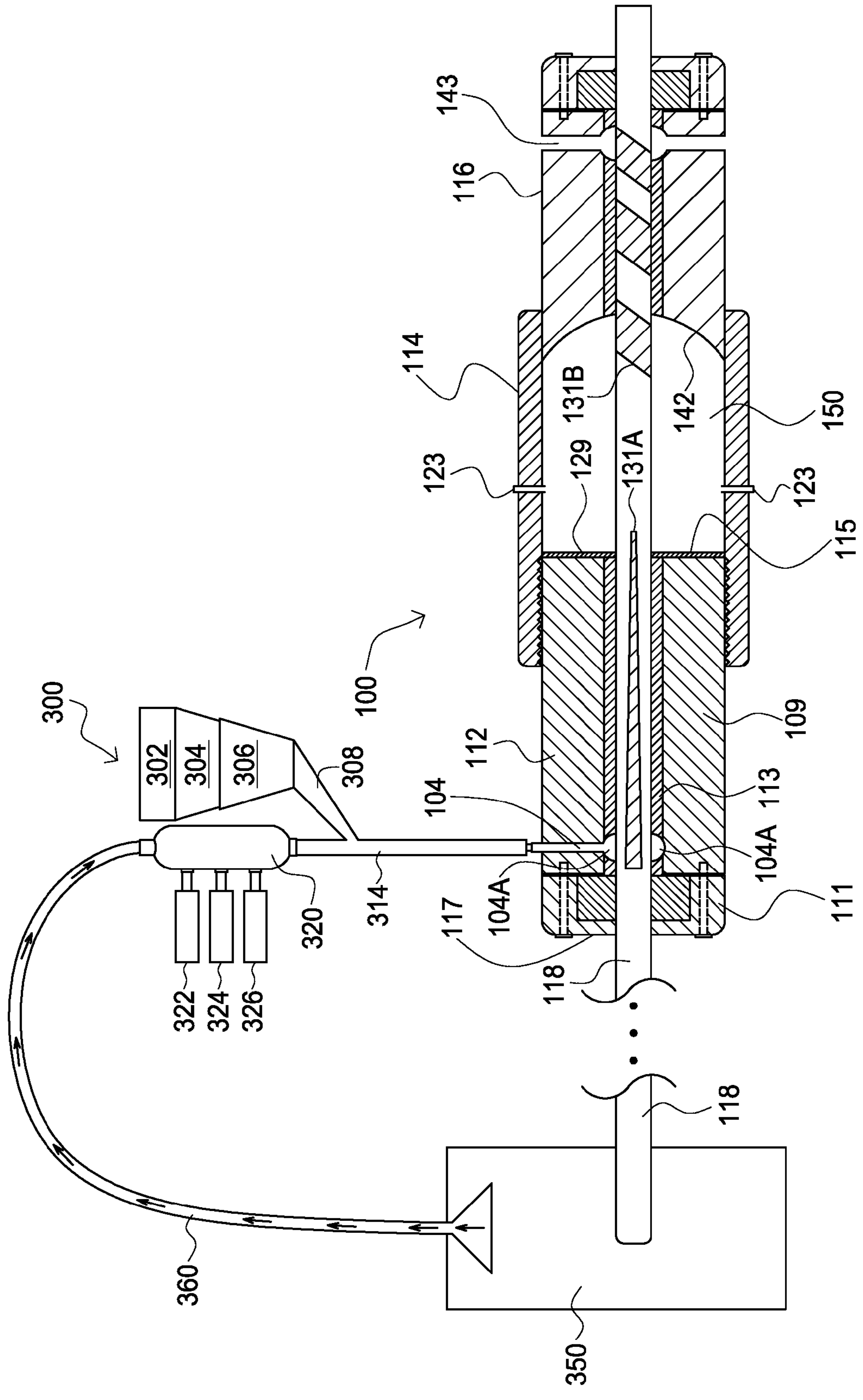
Fig. 5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350

Fig. 6

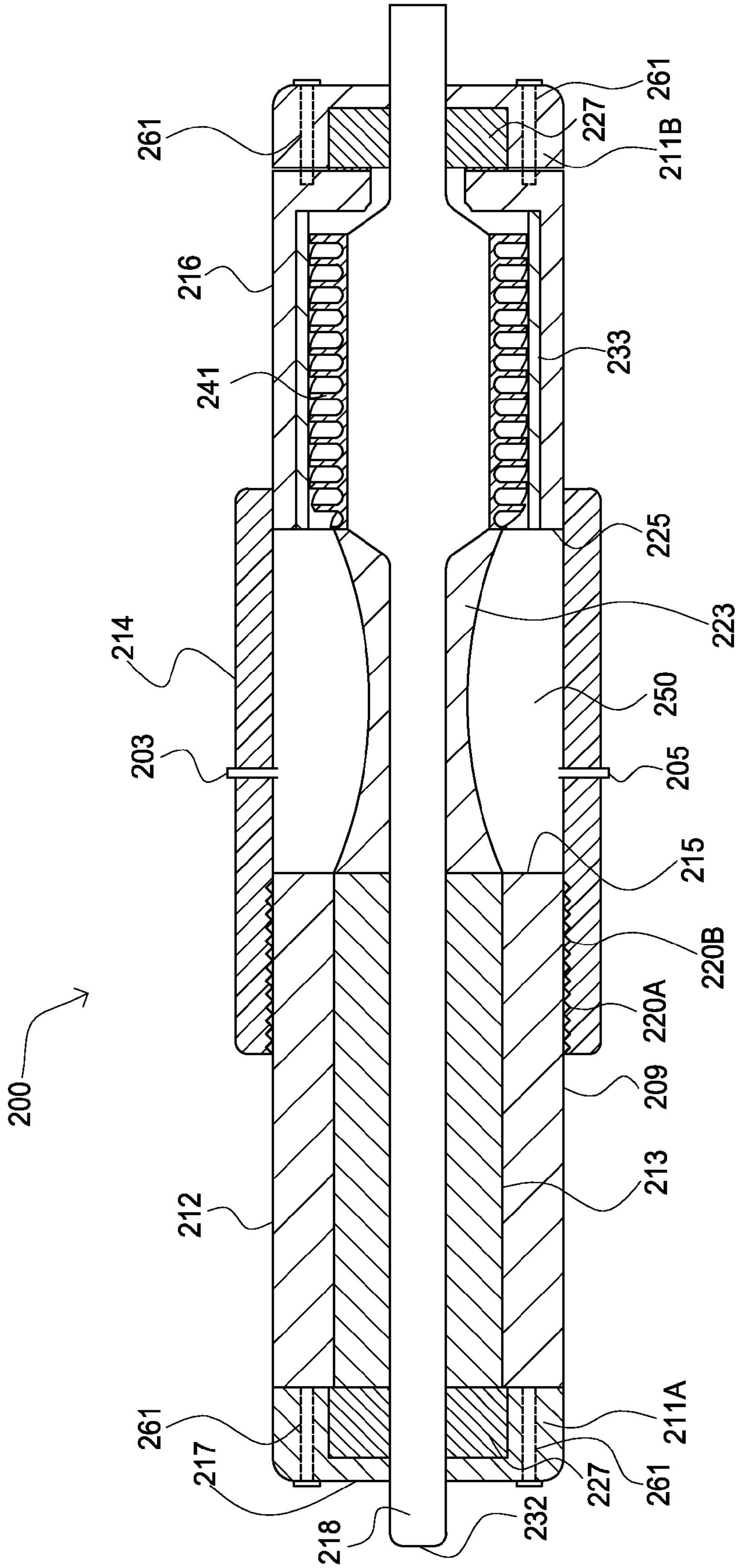
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Fig. 7

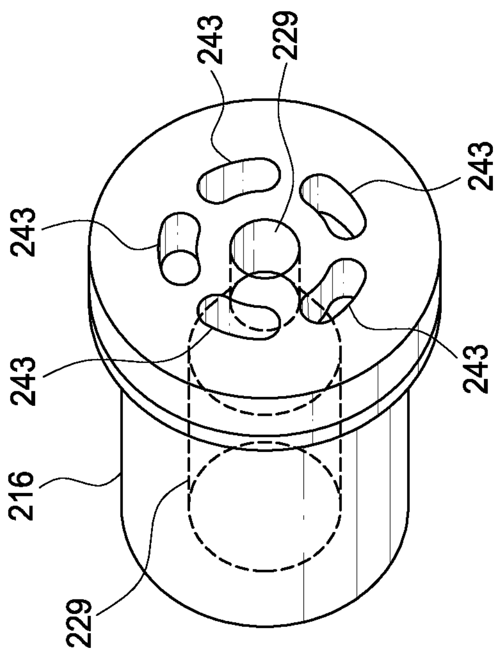

Fig. 8B

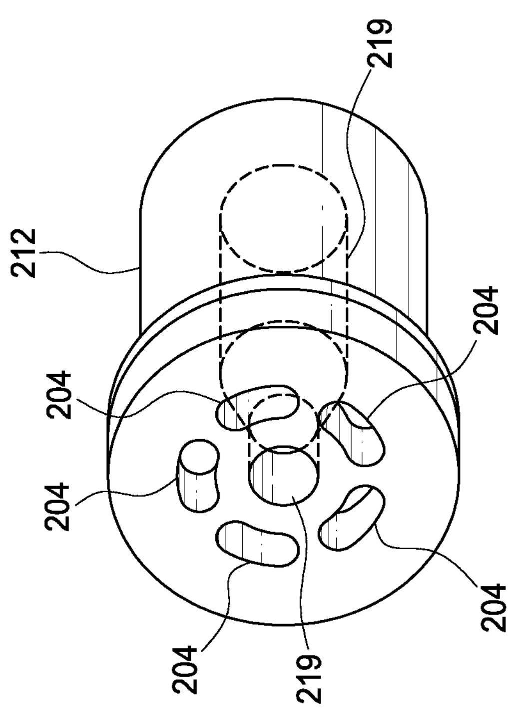

Fig. 8A

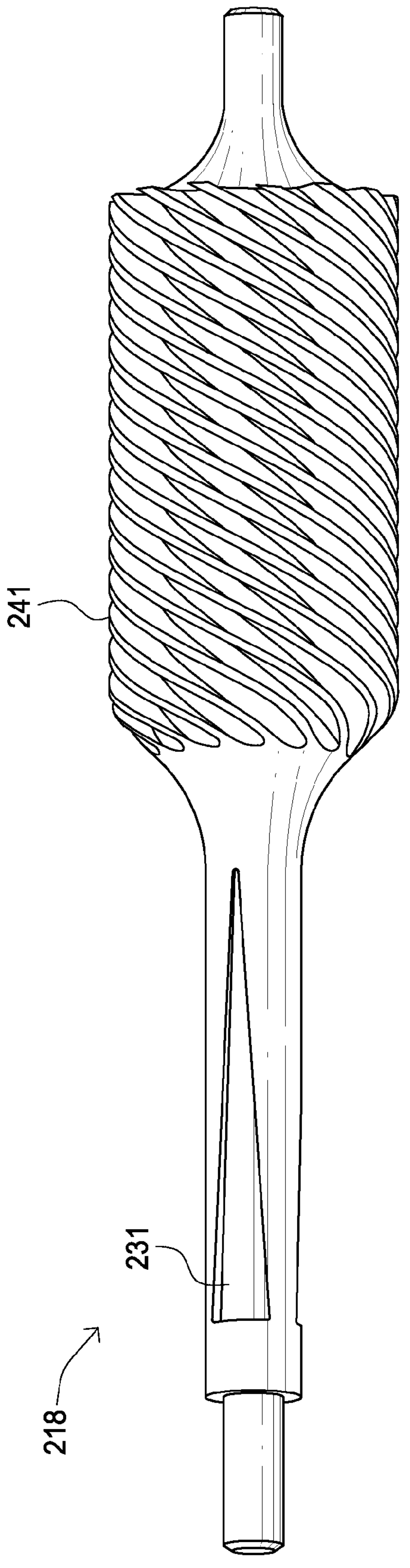

Fig. 9

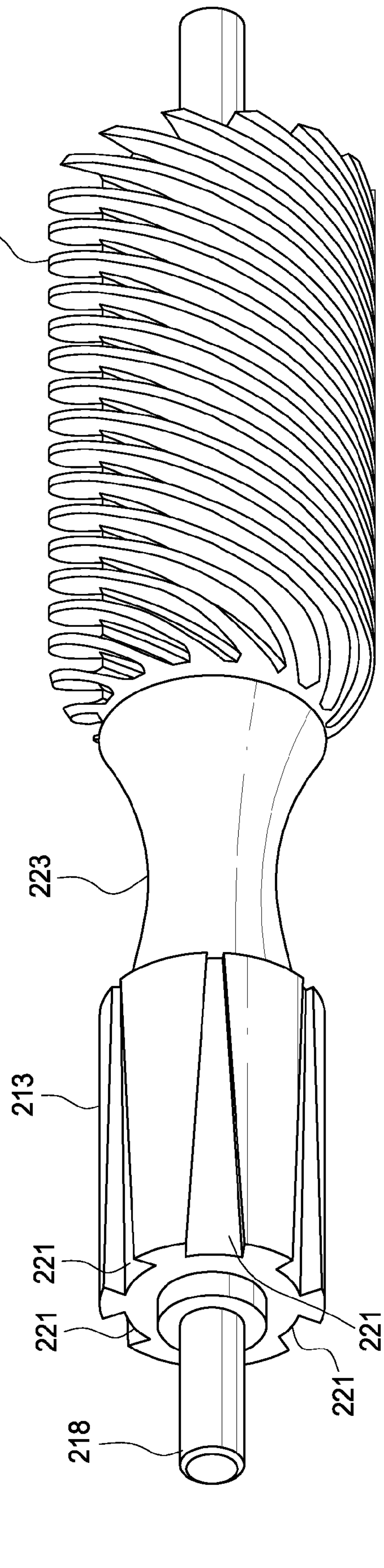

Fig. 10

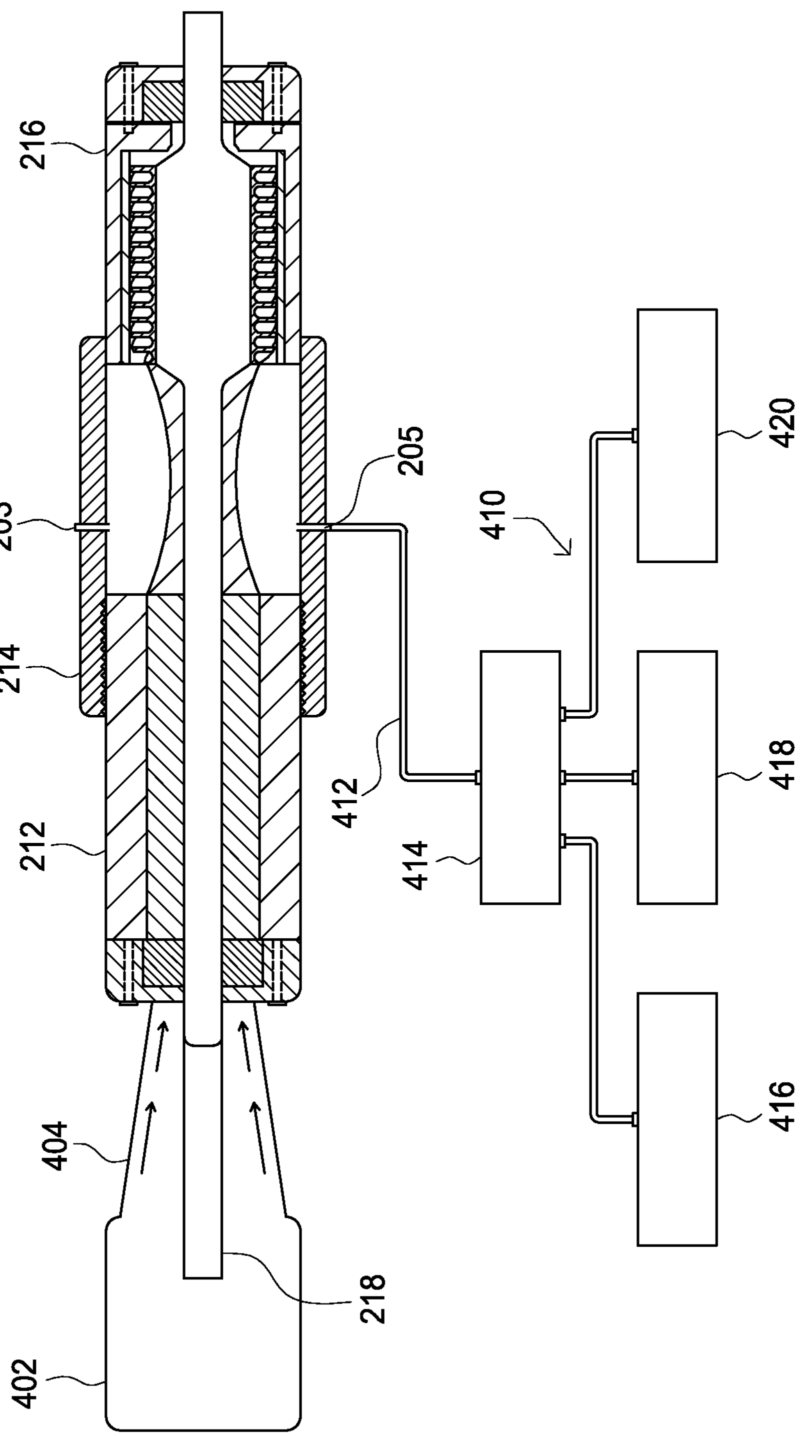

Fig. 11

SCREW SHAFT TURBINE COMPRESSOR AND SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of and claims priority to U.S. application Ser. No. 12/876,836, filed Sep. 7, 2010, which is a continuation-in-part of U.S. Pat. No. 7,788,896, issued Sep. 7, 2010, the full disclosure of both which are incorporated herein by reference.

FIELD OF THE INVENTION

This invention generally relates to compressor turbines.

BACKGROUND OF THE INVENTION

Compressor turbines are combustion rotary engines. Although combustion turbine engines come in various designs, each engine is defined by a compressor section adapted to increase the pressure on the air or air-fuel mixture, a combustion chamber which ignites the compressed mixture, and a coupled turbine portion. The energy released from the combustion chamber spins the turbine portion, which, in turn, powers and rotates the compressor section.

Turbine-compressor combustion engines were first patented in England in the late 18th century. However, it wasn't until the 20th century that turbines were developed which could be used to operate useful machinery. Particularly, axial-flow turbine compressors, where compressed fluid or gas flows generally parallel an axis of rotation, began to be developed and used in the aircraft industry during the 1940's. By the 1950's every major aircraft engine developer had moved to an axial-flow engine type.

Modern-day compressor turbines incorporate the use of blades to rotate and compress the fluid or gas. A typical axial compressor has a shaft which looks like a fan with blades, likely contoured, which are followed by a set of stationary blades, also known as stators. The blades may help increase efficiency of compressor designs. Additionally, axial compressors have a general conical shape, widest at the inlet, to compress the fluid or gas towards the combustion chamber.

The problem with many current turbine-compressor engines is that they are unreliable. Complex blade orientation design create increased breakdown opportunities, especially when the engines run at high output rates. Many of these maintenance problems cause safety hazards, either during repair or upon failure. Additionally, the fuel efficiency of many of these turbine engines, even with the use of fans, is uneconomical for many applications.

SUMMARY OF THE DRAWINGS

FIG. **1** is a side cut-away view of a screw shaft turbine compressor according to a first embodiment of the present invention.

FIG. **2** is an isometric view of a compressor section, a combustion section and a turbine section of a screw shaft turbine compressor without a screw shaft according to a first embodiment of the present invention.

FIG. **3** is an isometric view of a screw shaft according to one embodiment.

FIG. **4** is a side cut-away view of a screw shaft turbine compressor according to a second embodiment of the present invention.

FIG. **5** is an isometric view of a compressor section, a combustion section and a turbine section of a screw shaft turbine compressor without a screw shaft according to a second embodiment of the present invention.

FIG. **6** is a side cut-away and plan view of a system for generating torque on a shaft according to an embodiment of the present invention.

FIG. **7** is a side cut-away view of a screw shaft turbine compressor according to a third embodiment of the present invention.

FIG. **8**A is a perspective view of a compressor section of a screw shaft turbine compressor according to a third embodiment of the present invention.

FIG. **8**B is a perspective view of a turbine section of a screw shaft turbine compressor according to a third embodiment of the present invention.

FIG. **9** is an isometric view of a screw shaft according to a third embodiment of the present invention.

FIG. **10** is an isometric view of a screw shaft and bushings according to a third embodiment of the present invention.

FIG. **11** is a side cut-away and plan view of a system for generating torque on a shaft according to an embodiment of the present invention.

DETAILED DESCRIPTION

Embodiments of a screw shaft turbine compressor offer potentially greater reliability than prior art turbine compressors as the embodiments do not incorporate the use of blades to compress and direct fluid flow. Instead, embodiments rely on a grooved shaft to direct and compress fluid flow. In addition to the grooved shaft, embodiments are typically comprised of three sections: a compressor section, a combustion section, and a turbine section. However, a version is also contemplated that includes blades, also known as fins.

The combustion section can be a hollow cylinder having at least one ignition device. The combustion section material typically has high yield strength such as, but not limited to, hardened steel or a steel alloy. One end of the combustion section is adapted to couple to the compressor section and one end is adapted to couple to the turbine section. Embodiments can employ threaded sections to enable coupling, however, other coupling methods may be employed. The ignition device can be a spark plug and various composite materials may also be used as applicable.

Coupled to a first end of the combustion section of several embodiments is the compressor section. In some embodiments where the inner surface of a cylindrical combustion cylinder is threaded, the compressor section is also cylindrically-shaped and has threads on the outer surface of a portion of a distal end of the section. The compressor section outer surface threads are substantially adapted to mate with the combustion section inner surface threads. Also in an embodiment, the diameter of the compressor section distal end can be larger than the diameter of a compressor section proximal end.

The compressor section also includes a bore whose longitudinal axis is typically substantially parallel with the longitudinal axis of the compressor section. The center of the bore can be substantially aligned with the center of the outer surface of the distal end and the outer surface of the proximal end of the compressor section. The outer surface of each end is typically generally parallel to each other and perpendicular the compressor section's longitudinal axis. Encircling the bore can be a bushing comprised of ceramic or hardened steel. Included in the compressor section are one or more input or inlet ports. The one or more inlet ports are adapted to receive a substance such as, but not limited to, fuel, air, or a fuel-air mixture, and introduce the substance to the bore.

In embodiments, the turbine section can be generally a mirror-image of the compressor section. For example, the proximal end of the turbine section can be coupled to the combustion section through threads substantially similar to the compressor section's distal end threads. Additionally, the turbine section proximal end can have a diameter greater than the distal end. The turbine section bore can also substantially similar to the compressor section bore.

A difference between the compressor section and the turbine section is that one turbine section proximal end outer surface is generally not parallel to the turbine section distal end outer surface—nor is the proximal end outer surface generally perpendicular to the longitudinal axis of a turbine section bore. Although the distal end outer surface is generally parallel to the longitudinal axis of the turbine section, the proximal end outer surface is angled towards the distal end, ending in the bore generally located in the center of the surface. Therefore, the proximal end of the turbine section is generally conically-shaped or concave-shaped with the bore located at the cone apex. Another difference between the turbine section and the compressor section is that the turbine section has one or more exhaust ports instead of one or more inlet ports. The exhaust ports can be adapted to allow exhaust to be released from the bore.

The shaft is typically placed in through the compressor section, coupled combustion section, and turbine section bores. In addition to the bushing-lined bores, the shaft can be supported in with bearings. At least one bearing may be located within the compressor section and at least one bearing may be located in the turbine section. The shaft typically has at least one spiraled or helically-shaped groove on its surface. A first groove in a first embodiment spirals from a location proximal the compressor section intake port and ends at a location proximal the edge of the compressor section's distal end.

However, a similar first groove in a second embodiment can be a generally straight groove from a location proximal the compressor section inlet port and ends at a location proximal the edge of the compressor section's distal end. In some embodiments, the groove width is adapted to decrease as the distance towards the compressor section distal end decreases. A second groove typically comprises a spiraled or helical groove and generally extends from the combustion chamber to the one or more exhaust port in the turbine section. An exemplary embodiment of a system for generating torque on a shaft using embodiments of the screw shaft turbine compressor is also described herein.

In one embodiment, the screw shaft turbine compressor can include a shaft having a widened portion proximate the turbine section. The widened portion of the shaft can include one or more grooves. For instance, the one or more grooves can be spiraled or helical grooves. The compressor section can include a bushing having one or more grooves and the combustion section can include a bushing having a concave cylindrical shape. Further, the screw shaft turbine compressor can include intake ports and exhaust ports parallelly aligned with a longitudinal axis of the screw shaft turbine compressor.

Terminology:

The terms and phrases as indicated in quotation marks (" ") in this section are intended to have the meaning ascribed to them in this Terminology section applied to them throughout this document, including in the claims, unless clearly indicated otherwise in context. Further, as applicable, the stated definitions are to apply, regardless of the word or phrase's case, tense or any singular or plural variations of the defined word or phrase.

The term "or" as used in this specification and the appended claims is not meant to be exclusive rather the term is inclusive meaning "either or both".

References in the specification to "one embodiment", "an embodiment", "a preferred embodiment", "an alternative embodiment", "a variation", "one variation", and similar phrases mean that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least an embodiment of the invention. The appearances of phrases like "in one embodiment", "in an embodiment", or "in a variation" in various places in the specification are not necessarily all meant to refer to the same embodiment or variation.

The term "couple" or "coupled" as used in this specification and the appended claims refers to either an indirect or direct connection between the identified elements, components or objects. Often the manner of the coupling will be related specifically to the manner in which the two coupled elements interact.

The term "removable," "removably coupled," "readily removable," "threadably coupled," and similar terms, as used in this specification and appended claims, refer to structures that can be uncoupled from an adjoining structure with relative ease (i.e., non-destructively and without complicated or time consuming process), and can also be readily reattached or coupled to the previously adjoining structure.

The term "integrate" or "integrated" as used in this specification and the appended claims refers to a blending, uniting, or incorporation of the identified elements, components or objects into a unified whole.

Directional and/or relationary terms such as, but not limited to, left, right, nadir, apex, top, bottom, vertical, horizontal, back, front and lateral are relative to each other and are dependent on the specific orientation of a applicable element or article, and are used accordingly to aid in the description of the various embodiments and are not necessarily intended to be construed as limiting.

As applicable, the terms "about" or "generally" as used herein unless otherwise indicated means a margin of +−20%. Also, as applicable, the term "substantially" as used herein unless otherwise indicated means a margin of +−10%. It is to be appreciated that not all uses of the above terms are quantifiable such that the referenced ranges can be applied.

The term "composite", "composites" or any version thereof refers to a solid material which is composed of two or more substances having different physical characteristics and in which each substance retains its identity while contributing desirable properties to the whole.

First Embodiment of a Screw Shaft Turbine Compressor:

Referring to FIGS. **1**, **2**, and **3**, an embodiment **10** of a screw shaft turbine compressor is shown. In one embodiment, the screw shaft turbine compressor **10** is comprised of three sections: a compressor section **12**, a combustion section **14**, and a turbine section **16**. The screw shaft turbine compressor **19** can also include a shaft **18**. As best shown in FIG. **2**, the compressor section **12**, the combustion section **14**, and the turbine section **16** are generally cylindrically-shaped with generally circular cross-sections. Other embodiments may have only two sections or may have non-circular cross-sections as applicable.

In one embodiment, the sections are adapted to couple to each other. For example, as best shown in FIG. **2**, a portion of the compressor section **12** may be comprised of a thread **20** which is adapted to mate with a threaded portion of the combustion section **14**. Similarly, the combustion section may be adapted to couple with the turbine section through a set of threads adapted to mate with each other. It may be the ends of the combustion section cylinder that have the threads. Upon coupling the turbine section and compressor section to the combustion section, a combustion chamber **50** is created, as best shown in FIG. **1**. One side of the combustion chamber may be comprised of the compressor section, one side of the combustion chamber may be comprised of the turbine section, and at least one combustion chamber wall may be comprised of the combustion section.

Another embodiment may be unitary in nature, such as, an embodiment having three integrated sections. Yet one embodiment may also have three sections that are coupled through means other than mating threads. Additionally, one embodiment may be comprised of only two sections or more than three sections. The two sections may be integrated or may be adapted to couple to each other. Upon coupling, the two sections may comprise a combustion chamber **50**.

In a three section embodiment having a combustion section, the combustion section may have an outside diameter **22** of 8 inches and a length **24** of 6 inches. Embodiments are contemplated that have larger and smaller combustion sections, depending on the application. The combustion section is typically comprised of a material which is adapted to withstand the heat and pressure that occurs during turbine operation. For example, one combustion section may be comprised of steel or a steel alloy. Other materials, such as, but not limited to, composite materials may be used as well in an embodiment.

Included in the combustion section **14** in one embodiment is at least one ignition device **23**. One embodiment is comprised of two ignition devices, as best shown in FIG. **1**. The ignition device may be a device, such as, but not limited to, a spark plug, which is adapted to create an arc of electrical current between two electrodes. The arc of current creates a spark which ignites a fuel mixture in the combustion section.

In an embodiment having a combustion section **14** coupled to the compressor section **12** and the turbine section **16**, fuel may enter the combustion chamber **50** through a bore **19** located in the compressor section, as best shown in FIGS. **2** and **1**. The bore may extend from a compressor section proximal end **17** to a compressor section distal end **15**. The longitudinal axis of the bore is generally perpendicular to the compressor section proximal and distal ends in one embodiment. Additionally, the center of the bore is generally aligned with the center of the proximal and distal ends of the compressor section in one embodiment.

Surrounding the bore **19** in the compressor section **12** in one embodiment is a bushing **13**. An embodiment's bushing may not completely encircle the bore, but in one embodiment substantially surrounds the bore. The bushing may be comprised of ceramic or hardened steel. Other bushing materials are contemplated. The bushing is generally adapted to strengthen the bore. The compressor section may be comprised of a steel alloy or any other material which may be similar to the material the combustion section is comprised of.

In one embodiment, the compressor section **12** is comprised of two portions. An embodiment's first portion **11** has a first portion diameter **7** which is smaller than the diameter **5** of the second portion **9**. In one compressor section embodiment, the diameter increases from the first portion to the second portion in a generally linear manner and along an increasing diameter portion of the compressor section.

The length **3** of a first portion **11** may be about 4 inches and one first portion diameter may be about 4 inches. The length of one second portion **9** may be about 4 inches and a diameter of a second portion may be about 6 inches. In an embodiment, one length **2** of the increased diameter portion is less than the length or the diameter of the first portion or the second portion. One version may have an increased diameter portion length of 1 inch.

Included in one first portion **11** of a version is at least one inlet port **4**. A version may also include two inlet ports, as best shown in FIG. **1**, with one inlet port bore entrance **6** opposing the other inlet port bore entrance. The inlet ports are adapted to allow air, fuel, an air-fuel mixture, or any other substance to pass through the port and into the bore **19**. The longitudinal axis of the inlet ports of one embodiment are generally perpendicularly aligned with the longitudinal axis of the compressor section first portion and the bore. One inlet port may have a generally circular cross-sectional geometry, with a diameter **8** of the inlet port **4** varying over the inlet port length. The inlet port diameter in one embodiment may be larger at a bore entrance **6** than at an outer surface inlet port opening **26**. One inlet port may include a device such as, but not limited to, a nozzle, adapted to release fluid into the bore. The inlet port distance **28** from the compressor section's proximal end **17** in one embodiment may be equal to about 2 inches.

Included in the compressor section **12** in one embodiment may be a support mechanism such as, but not limited to, a rotatably adapted support mechanism. One rotatably adapted support mechanism may be a bearing **27**. The bearing is adapted to permit radial motion between the shaft **18** and the compressor section and may provide support to the shaft. One embodiment may use ball bearings as the bearing. Other bearings may also be used such, but not limited to, jewel bearings, fluid bearings, magnetic bearings, and flexure bearings. Fluid bearings may be gas bearings, hydrostatic bearings, hydrodynamic bearings, foil bearings, or journal bearings. Other radially adapted support mechanisms may be used.

The shaft **18** in one version is a cylindrical rod. The rod may have a generally circular cross-section. One shaft comprises a diameter **30** adapted to fit in the bore **19** in the compressor and turbine sections, as best shown in FIG. **1**. In one embodiment, the shaft diameter may be about 2 inches. One shaft version has an outer surface upon which there is at least one groove **31**, as best shown in FIG. **3**. In one embodiment, the groove may be a spiraled or helical groove. The groove may spiral from a shaft proximal end **32** towards a shaft distal end **33**. In one embodiment, the groove begins at a distance **34** from the proximal end, with one version's start distance being about 2 inches. In one embodiment, the beginning of the groove opposes the inlet port bore entrance **6**, as best shown in FIG. **1**. One version may have more than one groove.

To compress the mixture in one embodiment, the width **35** of the groove **31** in one embodiment decreases as the distance from the proximal end **32** of the shaft **18** increases. An ungrooved distance **36** between the grooves also decreases in one embodiment as the distance from the proximal end of the shaft increases, as best shown in FIGS. **1** and **3**. The grooves may also be referred to as spirals. Other groove designs adapted to compress the mixture are also contemplated. For instance, the depth of the groove may vary along its length.

In one embodiment, the groove width **35** is less than the shaft diameter **30**. A version's groove width at the groove start may be 1 inch. The proximal end **32** of the shaft in one embodiment may extend further than the proximal end **17** of the compressor section, upon the shaft being correctly placed in the compressor section, as best shown in FIG. **1**. Therefore, the inlet port distance **28** in a version is less than the groove start distance **34**. Upon coupling the combustion section **14** to the compressor section **12**, the shaft **18** in one embodiment is adapted to extend at least from the proximal end **17** of the compressor section into the combustion chamber **50**. The groove **31** in one embodiment ends after entering the combustion chamber.

However, in one embodiment, when the turbine section **16** is coupled to the combustion section **14**, the shaft **18** may be a single shaft which extends through the combustion chamber **50** and into the bore **19** located in the turbine section. The groove on the shaft may begin anew at the point proximal the shaft entering a turbine section bore. The width of the groove in the turbine section may stay substantially stable throughout the turbine section, and the distance between the groove in the turbine section may stay substantially stable as well. However, the width and distance between the groves may vary as well.

One embodiment's turbine section **10** is substantially similar to the compressor section **12**. However, the proximal end **40** of a turbine section may be coupled to the combustion section, whereas a distal end **15** of the compressor section may be coupled to the combustion section. Therefore, the turbine section may generally a mirror image of the compressor section, except for a conical surface, including bearings.

One difference between the compressor section and the turbine section is that the distal end surface **29** of the compressor section is generally perpendicular from the longitudinal axis of the bore **19**, whereas the proximal end surface **42** of the turbine section is generally a conical surface angled towards the distal end **41** and the bore. Another difference is that the port **43** on the turbine section is not an inlet port, but is an exhaust port.

Operation of one embodiment allows for an air-fuel mixture to enter into the bore **19** of the compressor section **12** through at least one inlet port **4**. As the fluid enters the bore, it is captured into the groove **31** on the shaft **19**. As the shaft spins, the fluid travels towards the combustion chamber **50**, being compressed in the process. Upon entering the combustion chamber, the fluid may be vaporized and ignited, with the combustion energy being directed on the shaft entering the turbine section, spinning the shaft, with the exhaust gas exiting out the exhaust port **43**.

Second Embodiment of a Screw Shaft Turbine Compressor:

Now referring to FIGS. **4** & **5**, a second embodiment of a screw shaft turbine compressor is shown. In one embodiment, the screw shaft turbine compressor **100** comprises three main sections—a compressor section **112**, a combustion section **114**, and a turbine section **116**. The second embodiment screw shaft turbine compressor **100** also includes a shaft **118**. As best shown in FIG. **8**, the three sections are generally cylindrically-shaped having generally circular cross-sections. Other variations and embodiments may have only two sections or may have non circular cross-sections as applicable. For example, a variation of the second embodiment may a single unitary section combining the combustion and turbine sections **114**, **116**. However, in such a variation, the combustion and turbine sections **114**, **116** would perform generally the same function as described herein.

Typically, the three sections **112**, **114**, & **116** of the second embodiment screw shaft turbine compressor **100** are coupled together in some manner. For example, as illustrated in FIG. **5**, a portion of the compressor section **112** can be comprised of one or more threads **120** which are adapted to mate or threadably engage with a threaded portion of the combustion section **114**. The combustion section **114** and the turbine section **116** of the second embodiment screw shaft turbine compressor **100** are typically welded or near-permanently adhered together in some fashion. However, in some variations the combustion section **114** can be adapted to couple with the turbine section **116** through one or more threads adapted to mate with each other as described with respect to the first embodiment screw shaft turbine compressor **10**. Upon coupling the turbine section **116** to the combustion section **114** and the compressor section **112** to the combustion section **114**, a combustion chamber **150** is created (FIG. **7**). One side of the combustion chamber **150** is typically comprised of the compressor section **112**, one side of the combustion chamber **150** is typically comprised of the turbine section **116**, and at least one combustion chamber wall is typically comprised of the combustion section **114**.

Advantageously, the threaded engagement between the compressor section **112** and combustion section **114** is adapted to enable variations in a distance **151** that an end of the one or more grooves **131***a* extends into the combustion chamber **150**. Moreover, the one or more grooves **131** can be a straight groove as best illustrated in FIG. **7**. In implementations of the second embodiment screw shaft turbine compressor **100**, the straight groove can be tapered and resembles a keyway along the shaft **118**. However, it is pertinent to note that the one or more grooves **131***a* can also be a spiraled or helical groove as described above with respect to the first embodiment screw shaft turbine compressor **10**. Moreover, the one or more grooves **131***a* are typically adapted to increases gas pressure of an air/fuel mixture as it enters the combustion chamber **150**.

Variations in the distance **151** change the amount of air/fuel mixture that can pass into the combustion chamber **150**. In one implementation, the distance **151** can be such that the resulting opening serving as an ingress point for the air/fuel mixture into the combustion chamber **150** is substantially smaller then the opening of the one or more grooves **131***b* serving as an egress point for the exhaust.

Moreover, the coupling between the compressor section **112** and combustion section **114** is typically by threaded engagement as illustrated in FIG. **8**. However, other ways of coupling these two sections together are contemplated such as but not limited to slidable engagement. The movable engagement between the compressor section **112** and the combustion section **114** allows for more precise and adjustable regulation of the air/fuel mixture flowing into the combustion chamber **150**. Additionally, the compressor section **112** and combustion section **114** can be welded together when the distance **151** is a specific distance adapted a particular air/fuel mixture entering the compressor chamber **150** is desired for an implementation of the second embodiment screw shaft turbine compressor **100**. However, as discussed with respect to the first embodiment screw shaft turbine compressor **10**, many variations and constructions of the three sections **112**, **114**, & **116** including, but not limited to, a unitary embodiment are contemplated.

In one version of the second embodiment screw shaft turbine compressor **100**, the combustion section **114** can have an outside diameter of approximately 11 inches whereby the threaded collar portion extending radially beyond the compressor and turbine sections **112**, **116** is approximately one inch in diameter. In one version, the combustion chamber **150** comprises a length of approximately 4 inches along the general longitudinal axis. However, it is to be appreciated that other versions and embodiments that have larger and smaller combustion sections and combustion chambers therein. Moreover, the combustion section is typically comprised of materials adapted to withstand the heat and pressure conditions present during operation of the second embodiment screw shaft turbine compressor **100**. For example, one implementation of the combustion section **114** can be comprised of steel or a steel alloy. Other materials, such as, but not limited to, composite materials can be used as well in a various embodiments.

Included in the combustion section **114** is at least one ignition device **123**. In an exemplary embodiment, the second embodiment screw shaft turbine compressor **100** includes two ignition devices disposed on generally opposite sides of the combustion chamber **150**, as best shown in FIG. **7**. The at least one ignition device **123** can be a device, such as, but not limited to, a spark plug, which is adapted to create an arc of electrical current between two electrodes. The arc of current creates a spark which ignites an air/fuel mixture in the combustion chamber **150**.

Typically, the air/fuel mixture enters the combustion chamber **150** through a channel created by a bore **119** extending longitudinally though the compressor section **112** and one or more grooves **131** on the shaft **118**. The bore **119** typically extends longitudinally from a compressor section proximal end **117** to a compressor section distal end **115**. In one implementation, the longitudinal axis of the bore **119** is generally perpendicular to the compressor section proximal and distal ends. Additionally, the center of the bore is typically generally aligned with the center of the proximal and distal ends **117**, **115** of the compressor section.

In some implementations, the bore **119** is surrounded by a bushing **113**. The bushing **113** may not completely encircle the bore in every implementation of the second embodiment screw shaft turbine compressor **100**, but in at least one version the bushing **113** substantially surrounds the bore **119**. The bushing **113** can be comprised of ceramic or hardened steel, however, other suitable materials known in the art are contemplated. The bushing **113** is generally adapted to strengthen the structural integrity of the bore **119** in relation to its operation with the shaft **118**. Moreover, the bushing **113** can (and typically does) extend into the turbine section **116**. It is important that the shaft **118** be closely fit in some implementations with the bushing **113** in the turbine section **116** in order to contain and direct high pressure exhaust gasses emanating from the combustion section **114**. Additionally, it is important that the bushing **113** sufficiently durable and hard as to withstand the extremely high temperatures associated with the exhaust gasses emanating from the combustion section **114** through the turbine section **116**.

The compressor section **112** can be comprised of a steel alloy or any other suitable material for its intended purpose. The compressor section **112** can be comprised of two portions. A compressor first portion **111***a* may have a generally equal diameter as that of the compressor second portion **109**. The compressor first portion **111***a* can be removably coupled to the compressor second portion **109** via one or more fasteners **161** such as, but not limited to, screws or bolts.

In at least one implementation of the second embodiment screw shaft turbine compressor **100**, the length (longitudinally with respect to the axis of the bore) of compressor first portion **111***a* may be about 4¼ inches and the diameter of the compressor first portion **111***a* may be about 9 inches. The length (longitudinally with respect to the axis of the bore) of the compressor second portion **109** may also be about 4¼ inches and the diameter of compressor second portion **109** may also be about 9 inches.

One or more inlet ports **104** are included in the compressor section **112**, typically in the compressor second portion **109**. As illustrated in FIG. **7**, only one inlet port **104** is disposed on the compressor second portion **109**. However, other versions or implementations can include two or more inlet ports. At an end of the inlet port proximal the bore, an arcuate or dome-like cavity **104***a* typically surrounds the entire bore **119** and shaft **118** therein. The one or more inlet ports **104** are adapted to allow air, fuel, air/fuel mixture, or any other fluid or suitable substance to pass through the inlet port **104**, then into the cavity **104***a* of the inlet port **104**, and into the bore **119**. The longitudinal axis of the inlet port **104** is typically perpendicularly aligned with the longitudinal axis of the compressor second portion **109** and the bore **119**. Moreover, an aperture and connector end of the inlet port **104** typically extend radially from the axis of the bore **119**. In some variations, the inlet port **104** may include a device such as, but not limited to, a nozzle, adapted to release fluid into the bore **119**. The nozzle, or a valve, may also eliminate or reduce backflow of exhaust into the inlet port **104** that may occur during combustion. Moreover, the nozzle or valve to eliminate or reduce backflow of exhaust may be disposed closer to the combustion chamber **150** in some implementations. Additionally, to substantially reduce backflow of exhaust from combustion within the combustion chamber **150**, the cross-sectional area or opening related to the air/fuel mixture input (coming from the compressor section **112**) can be made significantly smaller than the cross-sectional area or opening related to the exhaust egress (provided by the turbine section **116**). For example, in one implementation, the compressor section **112** and combustion section **114** can be adjusted so that effectively a pinhole provides the input into the combustion chamber **150**.

A rotatably adapted support mechanism such as, but not limited to, a bearing **127** is typically included in the compressor first portion **111***a*. However, the support mechanism can be located in the compressor second portion **109** in some implementations as well. The bearing **127** is generally adapted to permit rotational motion between the shaft **118** and the compressor section **112**. A version of the bearing **127** can include ball bearings. However, other versions bearings can also be used such, but not limited to, jewel bearings, fluid bearings, magnetic bearings, and flexure bearings. Fluid bearings may be gas bearings, hydrostatic bearings, hydrodynamic bearings, foil bearings, or journal bearings. It is to be appreciated that other radially adapted support mechanisms may be used alternatively or in conjunction with the bearing **127**.

The shaft **118** is typically a cylindrical rod having a generally circular cross-section. The shaft **118** typically comprises a diameter adapted to fit into the bore **119** in the compressor and turbine sections **112**, **116**, as best illustrated in FIG. **7**. In one version, the shaft **118** has a diameter of 2.1867 inches. The shaft **118** typically includes one or more grooves **131**. In a version of the shaft **118**, the one or more grooves **131** can comprise a first groove **131***a* and a second groove **131***b*. With respect to the shaft **118**, in an implementation of the one or more grooves **131** the first groove **131***a* is disposed proximal a shaft first end **132** and the second groove **131***b* is disposed distal the shaft first end **132**.

The first groove **131***a* can comprise an elongated channel extending longitudinally with respect to the axis of the shaft **118**. The elongated channel can be a generally quadrilateral polygon cutout from the surface of the shaft **118**. The elongated channel generally extends from the one or more inlet ports **104** to the combustion chamber **150**. The elongated channel can also be slightly tapered wherein the width at an end proximal the combustion chamber **150** is narrower than the end distal the combustion chamber **150**. In some implementation, the elongated channel can resemble a keyway along the shaft **118**. Additionally, the first groove **131***a* of the one or more grooves **131** can comprise a plurality of elongated channels extending from the one or more inlet ports **104** to the combustion chamber **150**. It is also pertinent to note that the first groove 13 la can also comprise a number of groove shapes such as, but not limited to, a spiraled or helical groove.

The second groove **131***b* of the one or more grooves **131** typically comprises a spiraled or helical groove. The second groove **131***b* generally extends from the combustion chamber **150** to the one or more exhaust ports **143**. In various implementations of both the first and second embodiment screw shaft turbine compressors **10** &**100**, an angle of the spiraled or helical groove with respect to the longitudinal axis of the shaft **118** can be varied to speed to torque ratios. Thus, a method of generating different speed to torque ratios on the shaft using embodiments of the screw shaft turbine compressor includes varying the angle to achieve the desired result. The angle is typically between approximately 30 and 70 degrees. In implementations where maximum power is desired, the angle can be very steep with the angle at approximately 60-70 degrees. The angle is best illustrated in FIG. **3** with respect to the first embodiment. Looking at the second groove **31** towards the shaft distal end **33**, the angle is formed the relative center of the groove or channel (as would be best seen if the shaft **18** were dissected in a longitudinal cross-section) relative to the longitudinal axis of the shaft **18**. In some implementations, the width of the second groove **31** in the turbine section can stay substantially stable throughout the turbine section. Moreover, the distance between adjacent turns of the second groove **31** in the turbine section may stay substantially stable as well. However, other implementations with varied widths and distances between adjacent turns are contemplated.

To compress the air/fuel mixture in the second embodiment screw shaft turbine compressor **100**, the width of the straight groove **13** la can be decreased as the distance from the shaft first end **132** of the shaft **118** increases. An ungrooved distance between the grooves **131***a* and **131***b* along the shaft **118** typically resides in the combustion chamber **150** as best illustrated in FIG. **7**. It is pertinent to note that other groove designs adapted to compress the mixture are also contemplated. For example, the depth of the groove may vary along its length.

The shaft first end **132** may extend further than the compressor section proximal end **117**, particularly when the shaft **118** is to be operatively coupled with another device or element. The shaft **118** typically is a single shaft which extends through the combustion chamber **150** and into the bore **119** located in the turbine section **116**. The groove on the shaft may begin anew at the point proximal the shaft **118** entering the turbine section bore.

As illustrated in FIGS. **4** & **5**, the turbine section **116** can be substantially similar to the compressor section **112**. However, the proximal end of the turbine section **116** can be coupled to the combustion section **114**, whereas the distal end of the compressor section **112** can be coupled to the combustion section **114**. A difference between the compressor section and the turbine section is that a distal end surface **129** of the compressor section **112** is typically perpendicular from the longitudinal axis of the bore **119**, whereas the proximal end surface **142** of the turbine section **116** is typically a generally concave surface with respect to the combustion chamber **150** formed by these surfaces. The turbine section **116** can also be comprised of two portions. A turbine first portion **111***b* may have a generally equal diameter as that of the turbine second portion adjacent thereto. The turbine first portion **111***b* can be removably coupled to the turbine second portion via one or more fasteners **161** such as, but not limited to, screws or bolts.

As similarly described with respect to the compressor section **112**, a rotatably adapted support mechanism such as, but not limited to, a bearing **127** is typically included in the turbine first portion **111***b* of the turbine section **116**. However, the support mechanism can be located in the turbine second portion in some implementations as well. The bearing **127** is generally adapted to permit rotational motion between the shaft **118** and the compressor section **112**. The removable coupling of the bearings **127** in both the compressor section **112** and the turbine section **116** enable easier maintenance or repair of the bearings **127**, as well as maintenance, repair, and/or replacement (pursuant to design choices, for instance) of the shaft **118**.

In operation, an air/fuel mixture or fluid enters into the bore **119** of the compressor section **112** through one or more inlet ports **104**. As the air/fuel mixture enters the bore **119**, it is captured into the groove **131***a* on the shaft **118**. As the shaft **118** spins and/or the air/fuel mixture is forced into the one or more inlet ports **104**, the air/fuel mixture travels towards the combustion chamber **150**. As previously discussed, the air/fuel mixture can be compressed in the process. Upon entering the combustion chamber **150**, the air/fuel mixture can be ignited. The combustion energy caused by ignition can be directed on the shaft **118** entering the turbine section **116**, thereby spinning the shaft **118** while the exhaust gas exits out the one or more exhaust ports **143**. Ignition timing can vary depending on the specific implementation of the second embodiment screw shaft turbine compressor **100**.

An Exemplary Embodiment of a System for Generating Torque on a Shaft

Now referring to FIG. **6**, an exemplary embodiment of a system for generating torque on a shaft is shown. A second embodiment screw shaft turbine compressor **100** may be used in the system. As previously described, the second embodiment screw shaft turbine compressor **100** comprises three main sections—a compressor section **112**, a combustion section **114**, and a turbine section **116**. The system also comprises a shaft **118** (which may be considered part of the shaft turbine compressor or part of the system) that extends though the second screw shaft turbine compressor **100**. The shaft **118** is rotatably coupled to the compressor section **112** and the turbine section **116**. It is pertinent to note that all contemplated embodiments and variation of the screw shaft turbine compressor described above can be used in the system.

Generally, the compressor section **112** comprises a compressor section bore and one or more inlet ports **104**. The one or more inlet ports **104** are adapted to provide an air/fuel mixture to the compressor section bore. The combustion section **114** is operatively coupled to the compressor section **112**. The combustion section **114** comprises a combustion chamber **150** and at least one ignition device **123**. The turbine section **116** is operatively coupled to the combustion section **114**. The turbine section **116** comprises a turbine section bore and one or more exhaust ports **143**. The one or more exhaust ports **143** are adapted to release exhaust from the turbine section bore. A circumferential channel may extend around the turbine section bore to the one or more exhaust ports **143** in a similar fashion as the circumferential channel or domed ring-like cavity **104***a* used in conjunction with the inlet ports **104**.

The system can also comprise an air compressor **350** and a fuel delivery assembly **300**. The air compressor **350** is operatively coupled to the shaft **118** typically proximal the compressor section proximal end **117**. The shaft **118** generally extend from the air compressor **350** through the compressor section **112**, the combustion section **114**, and then through the turbine section **116** where the shaft **118** can operatively couple to a source or device adapted to receive torque (e.g., a generator or other industrial applications). The air compressor **350** is further operatively coupled to the fuel delivery assembly **300** whereby a conduit **360** supplies forced air into a manifold **320** of the fuel delivery assembly **300**.

The fuel delivery assembly **300** comprises one or more fuel sources which combine in or proximal the manifold **320** to create the air/fuel mixture. For example, the one or more fuel sources can comprise a source **322** for propane, a source **324** for various hydrocarbons, and a source **326** for alcohols. Moreover, the fuel delivery assembly **300** can comprise a bin **302** for wood and/or coal, a hopper **304**, and a crusher **306**. The crushed wood and/or coal can be injected via a control flow nozzle **308**. The entire air/fuel mixture is then injected into the one or more inlet ports **104** via a conduit **314** into the compressor section **112**.

Similar to embodiments of the screw shaft turbine compressor, embodiments of the system for generating torque on a shaft include one or more grooves of various shapes and sizes. For example, the one or more grooves **131** can include one or more helically-shaped grooves **131***b* disposed on the shaft **118** along at least a portion of the combustion section **114** and at least a portion of the turbine section **116**. Additionally, the one or more grooves **131** can include one or more generally straight grooves **131***a* disposed on the shaft **118** along at least a portion of the compressor section **112** and at least a portion of the combustion section **114**. Hence, the variations and implementations of embodiments of the screw shaft turbine compressor can be applied to the system in order to customize it a given application.

Third Embodiment of a Screw Shaft Turbine Compressor:

Now referring to FIGS. **7-10**, a third embodiment **200** of a screw shaft turbine compressor is shown. Generally, the screw shaft turbine compressor **200** can include a compressor section **212**, a combustion section **214**, a turbine section **216**, and a shaft **218**. Similar to the second embodiment compressor **100**, the third embodiment compressor **200** sections **212**, **214**, and **216** can generally be cylindrically-shaped having generally circular cross-sections. Other variations and embodiments may have only two sections or may have non-circular cross-sections, as applicable. For example, a variation of the third embodiment compressor **200** may include a single unitary section combining the combustion section **214** and the turbine section **216**. However, in such a variation, the combustion section **214** and the turbine section **216** would perform generally a similar function as described herein. In one embodiment, the compressor section **212**, the combustion section **214**, and the turbine section **216** can be a single housing.

Typically, the compressor section **212**, the combustion section **214**, and the turbine section **216** of the third embodiment compressor **200** can be coupled together in some manner. For example, as illustrated in FIG. **7**, a portion of the compressor section **212** can be comprised of one or more threads **220***a* which are adapted to mate or threadably engage with a threaded portion **220***b* of the combustion section **214**. The combustion section **214** and the turbine section **216** of the third embodiment compressor **200** are typically welded or near-permanently adhered together in some fashion. For instance, the sections **214**, **216** can be interference fitted or compression fittings can be implemented to couple the sections **214**, **216** together. However, in some embodiments, the combustion section **214** can be adapted to couple with the turbine section **216** through one or more threads adapted to mate with each other as described with respect to the first embodiment screw shaft turbine compressor **10**.

Upon coupling the turbine section **216** to the combustion section **214** and the compressor section **212** to the combustion section **214**, a combustion chamber **250** can be created, as shown in FIG. **7**. A first side of the combustion chamber **250** can typically be comprised of the compressor section **212**, a second side of the combustion chamber **250** can typically be comprised of the turbine section **216**, and at least one combustion chamber wall can typically be comprised of the combustion section **214**.

Generally, the coupling between the compressor section **212** and combustion section **214** can be by threaded engagement as illustrated in FIG. **7**. However, other means and methods of coupling the compressor section **212** and the combustion section **214** together are contemplated including, but not limited to, a slidable engagement. The slidable engagement between the compressor section **212** and the combustion section **214** can allow for a more precise and adjustable regulation of an air/fuel mixture flowing into the combustion chamber **250**. However, as discussed with respect to the first embodiment screw shaft turbine compressor **10**, many variations and constructions of the three sections **212**, **214**, and **216** including, but not limited to, a unitary embodiment are contemplated.

In one embodiment, the combustion section **214** can have an outside diameter of approximately 11 inches, whereby a threaded collar portion extending radially beyond the compressor section **212** and the turbine section **216** can be approximately one inch in diameter.

In one embodiment, the compressor section **212** can comprise a length of approximately 18-20 inches along a general longitudinal axis, the combustion section **214** can comprise a length of approximately 24-26 inches along a general longitudinal axis, and the turbine section **216** can comprise a length of approximately 24-26 inches along a general longitudinal axis. It is to be appreciated that other versions and embodiments having larger and smaller compressor sections, combustion sections, turbine sections, and combustion chambers therein are contemplated. The combustion section **214** can typically be comprised of materials adapted to withstand the heat and pressure conditions present during operation of the third embodiment compressor **200**. For example, the combustion section **214** can be comprised of steel or a steel alloy. It is to be appreciated that other materials including, but not limited to, composite materials can be used as well in various embodiments.

Generally, the third embodiment compressor **200** can include at least one ignition device **203**. In one embodiment, the third embodiment compressor **200** can include two ignition devices disposed on generally opposite sides of the combustion chamber **250**. The ignition device **203** can be a device including, but not limited to, a spark plug and a flame igniter. The spark plug **203** can be adapted to create an arc of electrical current between two electrodes. The arc of current can create a spark that ignites an air/fuel mixture in the combustion chamber **250**. Ignition timing can vary depending on an implementation of the ignition device **203**. In one embodiment, the ignition timing of the ignition device **203** can be manually altered. In another embodiment, the ignition timing of the ignition device **203** can be controlled by an ignition system.

The compressor section **212** can include a first bore **219** extending longitudinally though the compressor section **212**, as shown in FIG. **8**A. The first bore **219** typically extends longitudinally from a proximal end **217** of the compressor section **212** to a distal end **215** of the compressor section **212**. In one implementation, a longitudinal axis of the compressor section bore **219** is generally perpendicular to the proximal and distal ends **217**, **215** of the compressor section **212**. Additionally, a center of the bore **219** is typically generally aligned with the center of the proximal and distal ends **217**, **215** of the compressor section **212**. A second bore **229** can extend longitudinally through the turbine section **216**, as shown in FIG. **8**B. The turbine section bore **229** can be generally perpendicular to proximal and distal ends of the turbine section **216**. In one embodiment, the turbine section bore **229** can have a larger diameter than the compressor section bore **219**.

In one embodiment, the compressor section **212** can include a bushing **213**. The compressor section bushing **213** can be adapted to fit inside the bore **219**. Typically, air can enter the combustion chamber **250** through one or more channels **221** on the compressor section bushing **213**. Generally, the compressor section bushing **213** can be comprised of ceramic or hardened steel, however, other suitable materials known in the art are contemplated.

The compressor section bushing **213** can have a generally cylindrical shape with the one or more channels **221** on an exterior of the bushing **213**, as shown in FIG. **10**. In one embodiment, the one or more channels **221** can have a wedge or tapered shape. In another embodiment, the one or more channels **221** can have a helical shape. The one or more channels **221** can be adapted to compress gases as they enter the combustion chamber **250**.

The compressor section bushing **213** can be removably coupled to the compressor section **212**. In one embodiment, one or more spacers can be implemented to removably couple the compressor section bushing **213** to the compressor section **212**. Generally, the spacers can be coupled to the compressor section **212** by fasteners including, but not limited to, screws and bolts. In one embodiment, the compressor section bushing **213** can be friction fitted inside the compressor section bore **219**.

In one embodiment, the combustion section **214** can include a bushing **223** coupled to the compressor section bushing **213**, as shown in FIGS. **7** and **10**. For instance, the combustion section bushing **223** can be threadably coupled to the compressor section bushing **213**. In another instance, the combustion section bushing **223** can be removably coupled to the compressor section bushing **213** via one or more fasteners including, but not limited to, screws or bolts. The combustion section bushing **223** can have a generally concave cylindrical shape, as shown in FIGS. **7** and **10**. The combustion section bushing **223** can be adapted to deliver exhaust from the combustion chamber **250** to a portion of the shaft **218** in the turbine section **216**.

The turbine section **216** can include a bushing **233**. The turbine section bushing **233** can have a generally cylindrical shape. In one embodiment, the turbine section bushing **233** can be friction fitted to the turbine section **216**. The turbine section bushing **233** can be adapted to ensure exhaust from the combustion chamber **250** interfaces with the portion of the shaft **218** in the turbine section **218**.

The compressor section bushing **213** and the turbine section bushing **233** can generally be adapted to strengthen a structural integrity of the compressor section bore **219** and the turbine section bore **229** in relation to an operation of the bores **219**, **229** with the shaft **218**. It is important that the shaft **218** be closely fit in some implementations with the turbine section bushing **223** in the turbine section **216** in order to contain and direct high pressure exhaust gasses emanating from the combustion chamber **250**. Additionally, it is important that the turbine section bushing **223** is sufficiently durable and hard as to withstand the extremely high temperatures associated with exhaust gasses emanating from the combustion chamber **250** through the turbine section **216**.

The compressor section **212** can be comprised of a steel alloy or any other suitable material for its intended purpose. The compressor section **212** can be comprised of two portions. A compressor first portion **211***a* may have a generally equal diameter as that of a compressor second portion **209**. The compressor first portion **211***a* can be removably coupled to the compressor second portion **209** via one or more fasteners **261** such as, but not limited to, screws or bolts.

In one implementation of the third embodiment compressor **200**, a longitudinal length, with respect to the axis of the bore **219**, of the compressor first portion **211***a* may be about 4¼ inches and a diameter of the compressor first portion **211***a* may be about 12 inches. A longitudinal length, with respect to the axis of the bore **219**, of the compressor second portion **209** may be about 4¼ inches and a diameter of the compressor second portion **209** may be about 12 inches.

One or more inlet ports **204** can be included in the compressor section **212**, typically in the compressor first portion **211***a*. As shown in FIG. **8**A, a plurality of inlet ports **204** are disposed on the proximal end **217** of the compressor first portion **211***a*. However, other versions or implementations can include one or more inlet ports similar to the inlet ports **104** of the second embodiment compressor **100**. The inlet ports **204** are adapted to allow air, fuel, air/fuel mixture, or any other fluid or suitable substance to pass through the inlet ports **204**. A longitudinal axis of the inlet ports **204** can typically be parallelly aligned with a longitudinal axis of the compressor first portion **211***a*. In one embodiment, the inlet ports **204** can be adapted to direct air into the channels **221** of the compressor section bushing **213** and the compressor section bore **219**.

In some embodiments, the inlet ports **204** can include a device including, but not limited to, a nozzle or valve adapted to release fluid into the bore **219**. The nozzle or valve may also eliminate and/or reduce backflow of exhaust into the inlet ports **204** that may occur during combustion. In one embodiment, the nozzle or valve may be disposed closer to the combustion chamber **250** to eliminate or reduce backflow of exhaust. Additionally, to substantially reduce backflow of exhaust from combustion within the combustion chamber **250**, a cross-sectional area or opening related to the air input (coming from the compressor section **212**) can be made significantly smaller than the cross-sectional area or opening related to the exhaust egress (provided by the turbine section **216**). For example, in one implementation, the compressor section **212** and the combustion section **214** can be adjusted so that effectively a pinhole sized aperture provides input into the combustion chamber **250**.

Generally, a fuel injector **205** can be included with the combustion section **214**. In one embodiment, at least two fuel injectors **205** can be included in the third embodiment compressor **200**. In one embodiment, the fuel injectors **205** can be located near a distal end **215** of the compressor section **212**. For instance, the fuel injectors **205** can be located such that fuel injected by the fuel injector interfaces with air entering the combustion chamber **250** through the bushing grooves **221**. In one embodiment, the fuel injector **205** can be part of an electronic fuel injection system. In another embodiment, the fuel injector **205** can be part of a mechanical fuel injection system. It is to be appreciated that the fuel injectors **205** would need to be connected to a source of fuel.

A rotatably adapted support mechanism **227** including, but not limited to, a bearing can typically be included in the compressor first portion **211***a*. However, the support mechanism **227** can be located in the compressor second portion **209** in some implementations as well. The bearing **227** can generally be adapted to permit rotational motion between the shaft **218** and the compressor section **212**. In one embodiment, the bearing **227** can include ball bearings. However, other embodiments of the bearing **227** can include, but are not limited to, jewel bearings, fluid bearings, magnetic bearings, and flexure bearings. Fluid bearings may be gas bearings, hydrostatic bearings, hydrodynamic bearings, foil bearings, or journal bearings. It is to be appreciated that other radially adapted support mechanisms may be used alternatively or in conjunction with the bearing **227**.

As illustrated in FIGS. **7** and **8**B, the turbine section **216** can be substantially similar to the compressor section **212**. However, a proximal end of the turbine section **216** can be coupled to the combustion section **214**, whereas the distal end of the compressor section **212** can be coupled to the combustion section **214**. The turbine section **216** can also be comprised of two portions. A turbine first portion **211***b* may have a generally equal diameter as that of a turbine second portion adjacent thereto. The turbine first portion **211***b* can be removably coupled to the turbine second portion via one or more fasteners **261** including, but not limited to, screws or bolts. One or more exhaust ports **243** can be included in the turbine section **216**, typically in the turbine first portion **211***b*, as shown in FIG. **8**B.

As similarly described with respect to the compressor section **212**, a rotatably adapted support mechanism **227** including, but not limited to, a bearing is typically included in the turbine first portion **211***b* of the turbine section **216**. However, the support mechanism **227** can be located in the turbine second portion in some implementations as well. The bearing **227** is generally adapted to permit rotational motion between the shaft **218** and the compressor section **212**. The removable coupling of the bearings **227** in both the compressor section **212** and the turbine section **216** enable easier maintenance or repair of the bearings **227**, as well as maintenance, repair, and/or replacement (pursuant to design choices, for instance) of the shaft **218**.

The shaft **218** can typically be a cylindrical rod having a generally circular cross-section. The shaft **218** can comprise a diameter adapted to fit into the first bore **219** in the compressor section **212** and the second bore **229** in the turbine section **216**. In one embodiment, a first portion of the shaft **218** can have a diameter of 2.1867 inches. A second portion of the shaft **218** can have a diameter of between 6-12 inches. It is to be appreciated that a diameter of the second portion of the shaft **218** can be varied to meet different design criteria.

Generally, a first end **232** of the shaft **218** may extend further than the compressor section proximal end **217**, particularly when the shaft **218** is to be operatively coupled with another device or element. The shaft **218** can typically be a single shaft which extends through the combustion chamber **250** and into the second bore **229** located in the turbine section **216**.

As shown in FIG. **9**, the shaft **218** typically includes one or more grooves **231**. The one or more grooves **231** can each include an elongated channel extending longitudinally with respect to an axis of the shaft **218**. The elongated channels **231** can be a generally quadrilateral polygon cutout from a surface of the shaft **218**. The elongated channels **231** generally extend from the one or more inlet ports **204** to the turbine section **216**. The elongated channels **231** can also be slightly tapered wherein the width at an end proximal the combustion chamber **250** is narrower than an end distal the combustion chamber **250**. For instance, the elongated channels **231** can resemble a keyway along the shaft **218**.

Additionally, the one or more grooves **231** can comprise a plurality of elongated channels extending from the one or more inlet ports **204** to the turbine section **216**. It is also pertinent to note that the one or more grooves **231** can also comprise a number of groove shapes including, but not limited to, a spiraled or helical groove.

In one embodiment, the one more grooves **231** can be tapered and resemble a keyway along the shaft **218**. However, it is pertinent to note that the one or more grooves **231** can also be a spiraled or helical groove as described above with respect to the first embodiment screw shaft turbine compressor **10**. Moreover, the one or more grooves **231** are typically adapted to increases gas pressure of air as it enters the combustion chamber **250** and the turbine section **216**.

In some embodiments, the shaft **218** can be widened starting at a proximal end **225** of the turbine section **216**, as shown in FIGS. **7**, **9**, and **10**. For instance, the widened portion of the shaft **218** can have a diameter that is 1.5-4 times a diameter of a portion of the shaft **218** in the compressor section **212**. Typically, the widened portion of the shaft **218** can include one or more grooves **241**. The one or more grooves **241** generally comprise a spiraled or helical groove and can extend from a distal end of the combustion chamber **250** to the one or more exhaust ports **243**. The one or more exhaust ports **243** can be adapted to release exhaust from the turbine section **216**. In one embodiment, a longitudinal axis of the exhaust ports **243** can typically be parallelly aligned with a longitudinal axis of a turbine first portion **211***b*.

In another embodiment, a tubular structure having helical grooves can be attached to the shaft **218**. Generally, the tubular structure can be concentrically attached to the shaft **218**, such that the tubular structure acts like a sleeve for the shaft **218**. The tubular structure can be operatively coupled such that when the tubular structure rotates, the shaft **218** rotates, or alternatively when the shaft **218** rotates, the tubular structure rotates.

It is to be appreciated that an angle and depth of the spiraled or helical grooves **241**, with respect to the longitudinal axis of the shaft **218**, can be varied to vary speed to torque ratios. Further, the number of helical grooves on the shaft **218** can be altered. For instance, a method of generating different speed to torque ratios on the shaft **218** using embodiments of the third embodiment compressor **200** can include, but is not limited to, varying an angle of the helical grooves **241** and/or increasing the number of helical spirals to achieve a desired result. Typically, the helical grooves **241** can be between approximately 30-70 degrees. In one embodiment, where maximum power is desired, an angle of the helical grooves **241** can be very steep with the angle at approximately 60-70 degrees.

Looking at the helical grooves **241**, the angle can be formed relative to a center of the groove (as would be best seen if the shaft **218** were dissected in a longitudinal cross-section) relative to a longitudinal axis of the shaft **218**. In some embodiments, a width of the helical grooves **241** in the turbine section can stay substantially stable throughout the turbine section. Moreover, the distance between adjacent turns of the helical grooves **241** in the turbine section may stay substantially stable as well. However, other implementations with varied widths and distances between adjacent turns are contemplated.

To compress air in the third embodiment compressor **200**, a width of the shaft grooves **231** and a width of the bushing grooves **221** can both be decreased as a distance from the shaft first end **232** of the shaft **218** increases. It is pertinent to note that other groove designs adapted to compress the mixture are also contemplated. For example, a depth of the shaft grooves **231** and the bushing grooves **221** may vary along a length of the shaft **218** and bushing **213** in the compressor section **212**.

In operation, air enters into third embodiment compressor **200** by the inlet ports **204**. Air is then directed to the bore **219** and the bushing grooves **221** on the bushing **213**. As air enters the bore **219**, air is captured into the grooves **231** on the shaft

218. Generally, air that passes through the bore **219** is introduced to the helical grooves **241** on the widened portion of the shaft **218** in the combustion chamber **250**. The grooves **231** on the shaft **218** act to compress the air before the air engages the helical grooves **241**. Further, air interfacing with the shaft grooves **231** can act to cool the shaft **218** in the combustion chamber **250**. Further, air from the shaft grooves **231** can supply oxygen to burn any unburned fuel entering the turbine section **216**.

As air is delivered to the combustion chamber **250** via the bushing grooves **221**, the bushing grooves **221** act to compress the air. As previously discussed, air can be compressed in the process. Upon entering the combustion chamber **250** from the bushing grooves **221**, air can be mixed with fuel injected into the combustion chamber **250** from the fuel injectors **205**. The air/fuel mixture can then be ignited by the ignition device **203**. The combustion energy caused by ignition can be directed to the helical grooves **241** of the shaft **218** by the combustion section bushing **223**. The exhaust gases entering the turbine section **216** can spin the shaft **218** while the exhaust gases then exit out the exhaust ports **243**. Ignition timing can vary depending on the specific implementation of the third embodiment compressor **200**.

An Exemplary Embodiment of a System for Generating Torque on a Shaft

Now referring to FIG. **11**, an exemplary embodiment of a system **400** for generating torque on a shaft is shown. A third embodiment screw shaft turbine compressor **200** may be used in the system **400**. As previously described, the third embodiment compressor **200** includes a compressor section **212**, a combustion section **214**, a turbine section **216**, and a shaft **218**. The shaft **218** may be considered part of the system **400** and generally extend though the third embodiment compressor **200** and be rotatably coupled to an air compressor **402**, the compressor section **212**, and the turbine section **216**. It is to be appreciated that all contemplated embodiments and variations of the screw shaft turbine compressor described above can be used in the system **400**.

The air compressor **402** can be included to generate an air flow for the third embodiment compressor **200**. Generally, an outlet **404** of the air compressor **402** can be fluidly connected to the inlet ports **204** of the third embodiment compressor **200**. As such, fluids exiting the outlet **404** of the air compressor **402** can be directed towards the inlet ports **204** of the third embodiment compressor **200**.

In one embodiment, the air compressor **402** can be an independent compressor adapted to generate an air flow for the third embodiment compressor **200**. For instance, a compressor bought from a store can be adapted to be fluidly coupled to the third embodiment compressor **200**. In another embodiment, the air compressor **402** can be built as part of the system **400**. As such, the air compressor **402** can be specifically adapted to be fluidly coupled to the third embodiment compressor **200**.

Generally, the air compressor **402** can be operatively coupled to the shaft **218** proximal the proximal end **217** of the compressor section **212**. The shaft **218** can generally extend from the air compressor **402** through the compressor section **212**, the combustion section **214**, and then through the turbine section **216** where the shaft **218** can operatively couple to a source or device adapted to receive torque including, but not limited to, a generator or other industrial applications.

The system **400** can further include a fuel injection system **410** operatively coupled to the fuel injectors **205** of the third embodiment compressor **200**. The fuel injection system **410** can be operatively coupled to the fuel injectors **205** whereby a conduit **412** supplies fuel to the fuel injectors **205**.

The fuel injection system **410** generally includes one or more fuel sources which combine in or proximal a manifold **414**. For example, the one or more fuel sources can comprise a source **416** for propane, a source **418** for various hydrocarbons, and a source **420** for alcohols. In one embodiment, the fuel injection system can comprise a bin for wood and/or coal, a hopper, and a crusher, similar to the previously disclosed system. It is to be appreciated that the fuel injector **205** can be adapted to inject the crushed wood and/or coal.

Alternative Embodiments and Variations

The various embodiments and variations thereof, illustrated in the accompanying figures and/or described above, are merely exemplary and are not meant to limit the scope of the invention. It is to be appreciated that numerous other variations of the invention have been contemplated, as would be obvious to one of ordinary skill in the art, given the benefit of this disclosure.

All variations of the invention disclosed in this application are intended and contemplated to be within the spirit and scope of the invention.

I claim:

1. A device comprising:

a compressor section including a compressor section bore and one or more inlet ports;

a combustion section operatively coupled to the compressor section;

a turbine section operatively coupled to the combustion section, the turbine section including a turbine section bore and one or more exhaust ports; and

a shaft rotatably coupled to the compressor section and the turbine section, the shaft having at least one helical groove disposed thereon;

wherein the shaft includes at least one tapered channel disposed on the shaft along at least a portion of the compressor section and at least a portion of the combustion section;

wherein the shaft extends from at least a portion of the compressor section, through the combustion section, and to at least a portion of the turbine section.

2. The device of claim **1**, wherein the compressor section further includes a bushing substantially surrounding the compressor section bore.

3. The device of claim **2**, wherein the bushing includes one or more grooves disposed thereon.

4. The device of claim **1**, wherein a longitudinal axis of each of the one or more inlet ports are parallelly aligned with a longitudinal axis of the compressor section.

5. The device of claim **1**, wherein the combustion section further includes a bushing having a generally concave cylindrical shape.

6. The device of claim **1**, wherein the shaft widens proximate a proximal end of the combustion section.

7. The device of claim **6**, wherein the widened shaft includes one or more grooves.

8. The device of claim **7**, wherein the one or more grooves of the widened shaft include one or more helically-shaped grooves disposed on the widened shaft.

9. The device of claim **1**, wherein a longitudinal axis of each of the one or more exhaust ports are parallelly aligned with a longitudinal axis of the turbine section.

10. The device of claim **1**, wherein the compressor section includes a support mechanism disposed within the compressor section.

11. The device of claim **10**, wherein the support mechanism includes bearings.

12. The device of claim **1**, wherein the turbine section includes a support mechanism disposed within the turbine section.

13. The device of claim **12**, wherein the support mechanism includes bearings.

14. The device of claim **1**, wherein the combustion section is (i) movably coupled to the compressor section and (ii) fixably coupled to the turbine section.

15. The device of claim **1**, wherein the combustion chamber includes at least one ignition device.

16. A system for generating torque on a shaft, the system comprising:

a shaft having one or more helical grooves disposed thereon;

a device operatively coupled to the shaft, the device comprising:

a compressor section including a compressor section bore and one or more inlet ports;

a combustion section operatively coupled to the compressor section, the combustion section including a combustion chamber, at least one fuel injector, and at least one ignition device; and

a turbine section operatively coupled to the combustion section, the turbine section including a turbine section bore and one or more exhaust ports;

an air compressor operatively coupled to the shaft; and

a fuel injection system having one or more fuel sources, the fuel injection system operatively coupled to the fuel injector;

wherein the shaft (i) is rotatably coupled to the compressor section and the turbine section, and (ii) extends from the air compressor, through the compressor section, through the combustion section, and through the turbine section;

wherein the shaft includes at least one tapered channel disposed on the shaft along at least a portion of the compressor section and at least a portion of the combustion section.

17. The system of claim **16**, wherein the compressor section further includes a bushing having one or more grooves disposed thereon, the bushing substantially surrounding the compressor section bore.

18. The system of claim **17**, wherein the one or more grooves are tapered.

19. The system of claim **16**, wherein the combustion section further includes a bushing having a generally concave cylindrical shape.

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